**Catalogue of American Amphibians and Reptiles.**

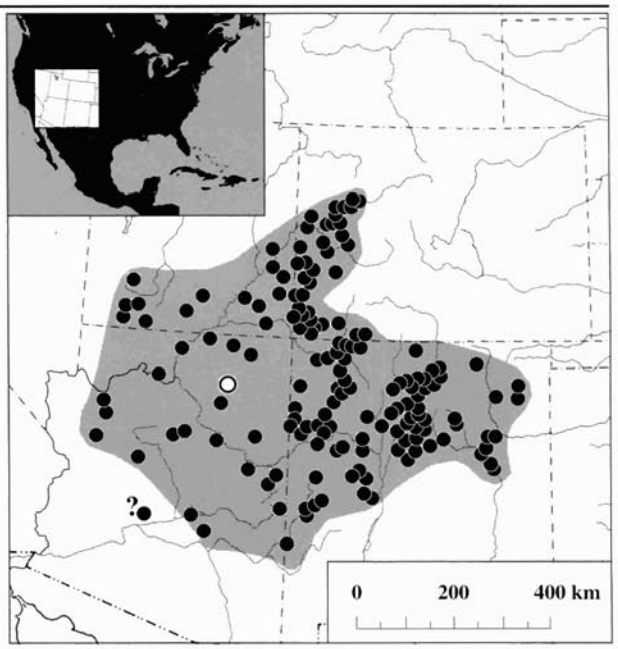
Stuart, J.N. 1998. *Cnemidophorus velox*.

## *Cnemidophorus velox* Springer
### Plateau Striped Whiptail Lizard

*Cnemidophorus sexlineatus*: Cope 1898 (1900):593 (part).
*Cnemidophorus gularis*: Cary 1911:27 (part).
*Cnemidophorus gularis velox* Springer 1928:102. Type locality, "Oraibi, Arizona, and ... Pueblo Bonito, New Mexico," designated "Lee's Ferry, Arizona" (Barbour and Loveridge 1946), restricted to "Oraibi, Navajo County, Arizona" (Lowe 1955). Lectotype, designated by Burt (1931) as Butler Univ. No. 848, now accepted as Museum of Comparative Zoology, Harvard University (MCZ) 37208 following Barbour and Loveridge (1946), an adult female, collected by S.H. Springer, August 1928 (not examined by author). See Remarks.
*Cnemidophorus sexlineatus perplexus*: Burt 1931:122 (part).
*Chemidophorus sexlineatus perplexus*: Barry 1932:38 (part). *Lapsus*.
*Cnemidophorus gularis octolineatus*: Smith 1946:409 (part).
*Cnemidophorus perplexus*: Maslin 1950:91 (part).
*Cnemidophorus inornatus*: Burger 1950:2 (part).
*Cnemidophorus sackii innotatus*: Burger 1950:4 (part). See Remarks.
*Cnemidophorus sacki innotatus*: Schmidt 1953:146 (part). Emendation.
*Cnemidophorus velox*: Lowe 1955:4. First use of combination.
*Cnemidophorus volex*: Taylor 1965:1. *Lapsus*.
*Cnemidophorus velox velox*: Smith 1987:126. See Remarks.

• **Content.** No subspecies are recognized (but see Remarks).

• **Definition.** *Cnemidophorus velox* is a parthenogenetic species complex of multiple hybrid origins within the *sexlineatus* species group (*sensu* Duellman and Zweifel 1962, Lowe et al. 1970), which exhibits the following combination of characters: maximum SVL 87 mm; 6 complete and well-defined longitudinal light stripes; occasionally a 7th light vertebral stripe, less distinct than the others and often undulating or intermittent (a complete vertebral stripe is most regularly seen in southern populations where *C. velox* overlaps in distribution with *C. uniparens*; however, a complete or partial stripe is often present in some northern populations also); areas between dorsal stripes blackish-brown or black and without distinct spotting, although very faint, indistinct spotting may be evident in the dorsolateral fields; venter white, often tinged with blue in life, and immaculate; distal two-thirds of tail light blue or greenish-blue. Scalation is as follows: 4–16 interlabial scales (total, both sides of head; granular interlabials typically lacking); usually 4 or more enlarged preanal scales; mesoptychial scales located immediately anterior to the gular fold abruptly enlarged and angular; postantebrachial scales




**Map.** Distribution of *Cnemidophorus velox*. The circle indicates the restricted type locality; dots mark other records. An extralimital record in Oregon is not mapped. The question mark indicates an uncertain record.

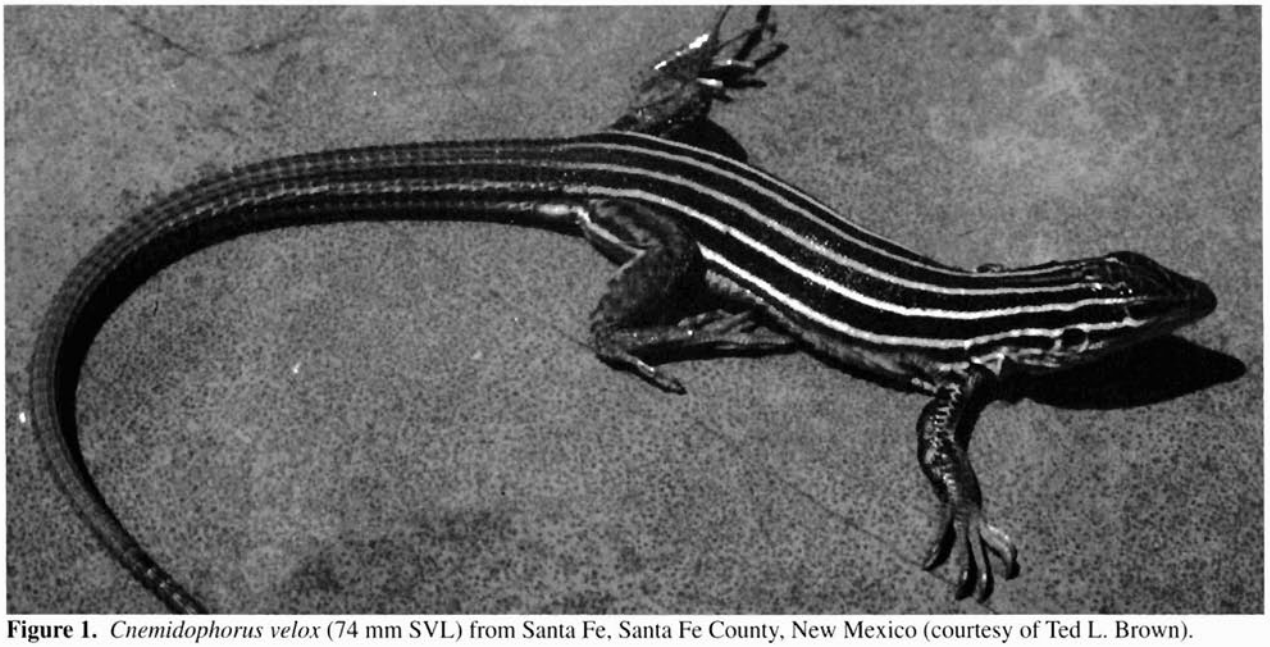


**Figure 1.** *Cnemidophorus velox* (74 mm SVL) from Santa Fe, Santa Fe County, New Mexico (courtesy of Ted L. Brown).

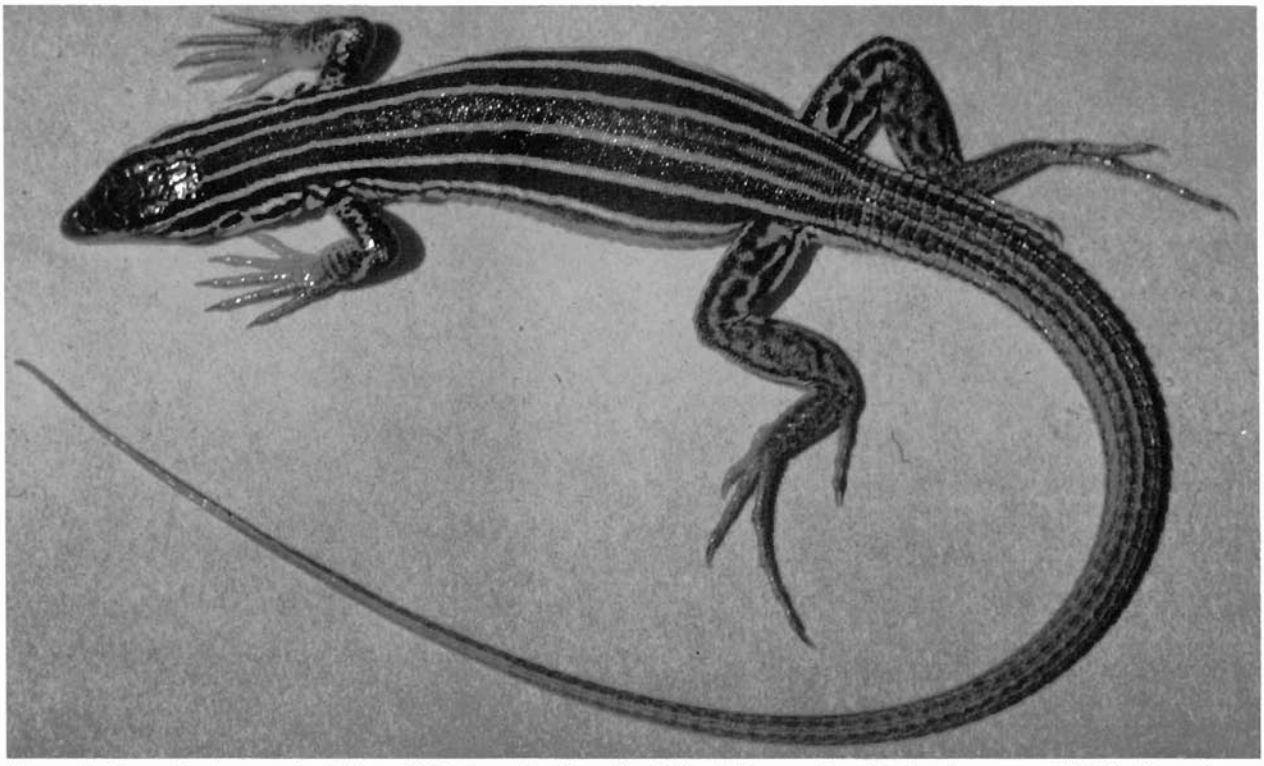


**Figure 2.** *Cnemidophorus velox* (80 mm SVL) from Tecolote, San Miguel County, New Mexico (courtesy of Ted L. Brown).

abruptly enlarged; 63–85 granular scales around torso at midbody (GAB); 3–11 granular scales between the paravertebral stripes (GBPS); supraorbital semicircle scales extend anteriorly no farther than the midpoint of the 3rd supraocular scale. The color pattern of neonates and juveniles is similar to that of adults although tail coloration is a brighter blue or blue-green and markings on the dorsal surface of the hindlimbs are distinctly yellow.

• **Diagnosis.** The well-defined striped dorsal pattern and lack of distinct dorsal spots in *C. velox* will distinguish it from most other *Cnemidophorus* within its range. The species is morphologically similar to two striped-unspotted congeners, *C. inornatus* (gonochoristic; diploid) and *C. uniparens* (unisexual; triploid); two or all three of these species occur in sympatry at many localities in New Mexico and Arizona (see Wright 1966, 1968; Degenhardt et al. 1996). *Cnemidophorus inornatus* differs from *C. velox* in the following characteristics: presence of males; maximum reported SVL = 85 mm (males) although most *C. inornatus* are <72 mm SVL; 6–8 light longitudinal stripes on dorsum; extensive blue coloration on ventral surface of body and on tail; 11–30 total interlabial scales (often in double rows); mesoptychial and postantebrachial scales granular to slightly enlarged; 52–78 GAB; 3–15 GBPS; supraorbital semicircle scales extend anteriorly to make contact with the 4th supraocular scale. *Cnemidophorus uniparens* differs from *C. velox* as follows: presence of only 6 complete longitudinal light stripes where the geographic ranges of the two species approach or overlap; lack of any spotting in the dorsal dark fields between stripes; an absence of ventral bluish coloration; 10–24 total interlabial scales; usually only three (occasionally two) enlarged preanal scales; 59–78 GAB; 4–8 GBPS.

The *C. velox* species complex (*sensu* Frost and Wright 1988, Wright 1993) is allotriploid, but one or more diploid forms have been included within the taxon (see Remarks). One of these diploid forms, *C. innotatus* Burger, a seven-striped, unspotted parthenospecies, may not be diagnosable at present using strictly morphological characteristics.

• **Descriptions.** The best descriptions are in Lowe (1955), Wright (1966, 1968), and Taylor (1965); others are in Duellman and Zweifel (1962), Wright and Lowe (1965), Stebbins (1985), Hammerson (1982), and Degenhardt et al. (1996). Pennock (1965, 1966) described the allotriploid karyotype (3n = 68). Identification keys that include this species were provided by Wright (1968), Lowe et al. (1966), Vance (1978), and Degenhardt et al. (1996). Additional meristic and mensural data are in Maslin (1950), Gehlbach (1965), Taylor (1965), and Wright (1967).

• **Illustrations.** Black-and-white photographs are in Duellman and Zweifel (1962), Gehlbach (1965), Taylor (1965), Wright and Lowe (1965), Lowe et al. (1966), Wright (1968), and Dessauer and Cole (1989). Color photographs or drawings are in Wauer (1964), Behler and King (1979), Hammerson (1982), Smith and Brodie (1982), Stebbins (1985), Livo (1992), Wright (1993), Williamson et al. (1994), Brown et al. (1995), and Degenhardt et al. (1996). Woodbury (1931) presented a photograph of an individual with a bifurcated tail. Gehlbach (1965) illustrated an ontogenetic series. Taylor et al. (1967) provided a photograph of a male subsequently determined to be a hybrid of *C. velox* and *C. tigris* (Taylor et al. 1989). Wright (1966) illustrated gular scutellation. Cuellar and Wright (1992) illustrated specimens used in a skin grafting experiment. Photographs of chromosomes and the karyotype are in Pennock (1965). Line drawings of the parietal eye-pineal morphology are in Gundy and Wurst (1976) and of the internal ear structure in Wever (1978). Photographs of habitat are in Wauer (1964), Taylor (1965), Wright and Lowe (1968), Dessauer and Cole (1989), and Degenhardt et al. (1996).

• **Distribution.** *Cnemidophorus velox* ranges from southern Utah and southwestern Colorado southward to north-central and eastern Arizona and northern and western New Mexico where it is associated with the Colorado Plateau and outlying mountain ranges in the Lower Basin and Range region. The species occurs primarily in Great Basin conifer woodlands (juniper-pinyon communities) and marginally in Rocky Mountain montane

conifer forests (ponderosa pine communities), Great Basin desert scrub (sagebrush-dominated communities), plains and Great Basin grasslands (including juniper transition zones), and encinal communities of Madrean evergreen woodland and interior chaparral (*sensu* Brown 1982). Riparian broadleaf forests in uplands are also inhabited. The primary elevations of occurrence are ca. 1800–2440 m, but these lizards also descend to ca. 1200 m, such as along riparian corridors in the southern part of their range. Extralimital (apparently introduced) populations of *C. velox* occur at The Cove Palisades State Park, Jefferson County, Oregon (Nussbaum et al. 1983, Stebbins 1985, Moritz et al. 1989b), and possibly at Phoenix, Maricopa County, Arizona (L.J. Vitt, pers. comm. *in* Degenhardt et al. 1996).

• **Fossil Record.** None.

• **Pertinent Literature.** Although the literature on systematics and taxonomy of *C. velox* is extensive (see Remarks), comprehensive studies of natural history and ecology are lacking. A number of studies discussed habitat, biogeography, and species associations (McCoy 1962; Harris et al. 1963; Gehlbach 1965; Wright 1966; Wright and Lowe 1968; Jones 1970; Bernard and Brown 1977; Cuellar 1977b, 1979; Morafka 1977; Hammerson 1981; Jones 1981, 1988; Lambert and Reid 1981; Johnson 1986; Cole and Dessauer 1995; Degenhardt et al. 1996). Other aspects of natural history which have been studied include reproduction (Maslin 1950; Gehlbach 1965; Douglas 1966; Cuellar 1968, 1970; Jones 1970; Jones et al. 1982), occurrence of males (Maslin 1962, 1966; but see Gehlbach 1965; Taylor 1965; Taylor et al. 1967, 1989), copulation with males of other species (Maslin 1966), pseudocopulation (Crews and Fitzgerald 1980, Cole and Townsend 1983), diet (Woodbury 1928, 1931; Knowlton 1934, 1937; Knowlton and Thomas 1934; Knowlton and Nye 1946; Douglas 1966), endoparasites (Douglas 1966, McAllister 1992), foraging and home range (Jones et al. 1985, Bowker et al. 1986a), and metabolic rate and thermoregulatory behavior (Bowker 1985, 1993; Bowker et al. 1986a, b). Ireland et al. (1994) studied effects of mine reclamation on *C. velox* and other species. Maslin (1966), Cole and Townsend (1977), and Townsend and Cole (1985) discussed captive propagation. Specimens of *C. velox* were used by Presch (1971, 1974a, b) in studies of tongue structure, dental morphology, and osteology of macroteiids; by Gundy and Wurst (1976) in a study of the parietal eye and pineal morphology in lizards; and by Taylor (1940) in a study of palatal sesamoid bones and palatal teeth in *Cnemidophorus*. Price (1983) and Degenhardt et al. (1996) provided partial reviews of the literature.

References with specific locality data include Maslin (1959), Duellman and Zweifel (1962), Harris et al. (1963), Lowe (1964), Smith et al. (1965), Taylor (1965), Wright (1966, 1968), Secoy and Brown (1968), Jones (1970), Tanner (1975), Jones et al. (1981), Hammerson (1981, 1982), Buus (1983), Smith and Thompson (1993), and Degenhardt et al. (1996). Regional studies which mentioned *C. velox* (or a synonym) include Tanner (1928, 1940), Woodbury (1928, 1931), Barry (1932), Franke (1932), McKee and Bogert (1934), Tanner and Hayward (1934), Cowles and Bogert (1936), Maslin (1947), Durham (1956), Hayward et al. (1958), Tanner (1958), McCoy (1962), Wauer (1964), Hulse (1973), Aitchison and Tomko (1974), and Tomko (1975). Some studies (e.g., Eaton 1935, Dean and Stock 1961) apparently included individuals of other species of *Cnemidophorus* in their samples of *C. velox*. Synonymies are provided in Maslin (1959), Duellman and Zweifel (1962), and Maslin and Secoy (1986). Early references to *C. velox* under other names included Cary (1911), Ellis and Henderson (1913, 1915), Cockerell (1927), Burt (1931, 1933), and Maslin (1947); see also Gehlbach (1965).

• **Remarks.** Springer (1928) failed to designate a holotype or a specific type locality in his original description. Burt (1931) subsequently designated Butler Univ. No. 848, one of Springer's four cotypes, as the lectotype and provided a vague type locality taken from Springer's (1928) account of the distribution. Barbour and Loveridge (1946) reported the type locality for this specimen as Lee's Ferry, a region (not the town) in northwestern Arizona defined by Springer (1928). Lowe's (1955) restriction of the type locality to Oraibi, Arizona, has been followed by most workers, although Maslin and Secoy (1986) argued for the validity of Pueblo Bonito (Chaco Culture National Historical Park, San Juan County), New Mexico (designated by Smith and Taylor [1950a, b], as the type locality). Lowe (1955), Maslin (1959), Wright (1966), and Maslin and Secoy (1986) discussed the history of the type designations.

The unisexual status of *C. velox* was first reported by Duellman and Zweifel (1962) and Maslin (1962). Additional evidence was provided by Gehlbach (1965), Maslin (1966), and Cuellar (1968). Lowe and Wright's (1966) hypothesis for an allotriploid ancestry of *C. velox* was verified by later studies, beginning with Neaves (1969). Based on data from allozyme and mitochondrial-DNA analyses, triploid lineages of *C. velox* probably arose by the hybridization of one or more male *C. inornatus* with an allodiploid intermediate form (or forms). This diploid intermediate (presumably partheno-genetic and possibly now extinct) originated by one or more earlier hybrid events involving a male *C. inornatus* and a female *C. costatus barrancorum* or *C. burti stictogrammus* (Dessauer and Cole 1989; Moritz et al. 1989a, b, 1992). The observation by Cuellar (1977a) that *C. velox* is composed of multiple, genetically distinct lineages was later supported by Dessauer and Cole (1989), Moritz et al. (1989b), and Cuellar and Wright (1992). Cole (1975) reviewed some of the literature concerning the ancestry of *C. velox*, and Borkin (1978) briefly reviewed the findings of Cuellar (1977a).

The taxonomic treatment of *Cnemidophorus* parthenoforms remains controversial (Cole 1985, 1990; Frost and Hillis 1990; Wright 1993). Morafka (1977), among others, did not consider *C. velox* and its parthenogenetic congeners as valid species. Walker (1986) erected an informal classification system for parthenoforms in the genus and designated *C. velox* as "*C.* 'velox'-A" or "VEL-A," a variant within the *velox* species complex (*sensu* Walker 1986). Smith (1987) proposed that Walker's variants within the species complex could potentially be classified as subspecies (*C. velox* would be designated *C. v. velox*). Recognizing that multiple lineages are contained under the name *velox*, Frost and Wright (1988) and Wright (1993) suggested that nominal *C. velox* probably should be referred to as the *C. velox* complex, pending further clarification of ancestry. Maslin (1968) and Frost and Wright (1988) noted that *C. velox* and *C. uniparens* are genetically more dissimilar than their morphological characteristics suggest. However, Dessauer and Cole (1989) and Parker et al. (1989) proposed that lineages encompassed by the names *C. velox* and *C. uniparens* may be considered as clonal variants of one nominal species (*velox*), an arrangement suggested earlier by Maslin (1966). The arrangement presented by Wright (1993, 1994) is followed in this review.

Wright (1993, 1994) regarded the diploid parthenoform described as *C. sackii innotatus* by Burger (1950) as specifically distinct from *C. velox*, and probably very similar to if not identical with the diploid intermediate form which was ancestral to both *C. velox* and *C. exsanguis*. The geographic distribution of *C. innotatus* outside of the type locality (the vicinity of Kanab, Kane County, Utah) is apparently unknown. Specimens assignable to *innotatus* have been included under the name *velox* (e.g., Lowe 1955) and vice versa (e.g., Stebbins 1954), and some

references included herein may actually refer to *C. innotatus* (e.g., Knowlton 1934, 1937). Additional undescribed diploid forms currently contained under the name *C. velox* may occur in New Mexico (Cuellar and Wright 1992).

• **Etymology.** The name *velox* (L., "swift, quick") refers to the elusiveness of this whiptail.

• **Comment.** Geographic variation in the development of the seventh (vertebral) dorsal stripe in *C. velox* may reflect the genetic variation among populations in the species complex. The possibility exists that some independently derived lineages of triploid and possibly diploid *Cnemidophorus* currently included in the complex will be recognized as distinct species.

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**James N. Stuart**, Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM 87131–1091.

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